Topic: Linearization

Question: What is the linearization of $f(x) = 2x^3$ at $a = 6$?

Answer choices:

A $L = 216x + 864$

B $L = 216x - 864$

C $L = 216x - 1{,}728$

D $L = 216x + 1{,}728$

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Solution: B

We'll start by finding $f(a)$.

$$f(a) = 2a^3$$

So for $f(6)$ we get

$$f(6) = 2(6)^3$$

$$f(6) = 432$$

Then $f'(a)$ is

$$f'(a) = 6a^2$$

So $f'(6)$ is

$$f'(6) = 6(6)^2$$

$$f'(6) = 216$$

Now we can solve for the linearization using $f(6) = 432$, $f'(6) = 216$, and $a = 6$.

$$L = f(a) + f'(a)(x - a)$$

$$L = 432 + 216(x - 6)$$

$$L = 432 + 216x - 1{,}296$$

$$L = 216x - 864$$

This is the linearization of the original function.

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Topic: Linearization

Question: What is the linearization of $f(x) = 4\sin(x)$ at $a = \pi/6$?

Answer choices:

A $L = 2\sqrt{3}x - \dfrac{6 - 2\sqrt{3}\pi}{3}$

B $L = 2\sqrt{3}x - \dfrac{6 - \sqrt{3}\pi}{3}$

C $L = 2\sqrt{3}x + \dfrac{6 - 2\sqrt{3}\pi}{3}$

D $L = 2\sqrt{3}x + \dfrac{6 - \sqrt{3}\pi}{3}$

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Solution: D

We'll start by finding $f(a)$.

$$f(a) = 4\sin(a)$$

So for $f(\pi/6)$ we get

$$f\left(\frac{\pi}{6}\right) = 4\sin\left(\frac{\pi}{6}\right)$$

$$f\left(\frac{\pi}{6}\right) = 4\left(\frac{1}{2}\right)$$

$$f\left(\frac{\pi}{6}\right) = 2$$

Then $f'(a)$ is

$$f'(a) = 4\cos(a)$$

So $f'(\pi/6)$ is

$$f'\left(\frac{\pi}{6}\right) = 4\cos\left(\frac{\pi}{6}\right)$$

$$f'\left(\frac{\pi}{6}\right) = 4\left(\frac{\sqrt{3}}{2}\right)$$

$$f'\left(\frac{\pi}{6}\right) = 2\sqrt{3}$$

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Now we can solve for the linearization using $f(\pi/6) = 2$, $f'(\pi/6) = 2\sqrt{3}$, and $a = \pi/6$.

$$L = f(a) + f'(a)(x - a)$$

$$L = 2 + 2\sqrt{3}\left(x - \frac{\pi}{6}\right)$$

$$L = 2 + 2\sqrt{3}x - \frac{2\sqrt{3}\pi}{6}$$

$$L = 2 + 2\sqrt{3}x - \frac{\sqrt{3}\pi}{3}$$

$$L = 2\sqrt{3}x + \frac{6 - \sqrt{3}\pi}{3}$$

This is the linearization of the original function.

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Topic: Linearization

Question: What is the linearization of $f(x) = -x^2 + 5x - 4$ at $a = -4$?

Answer choices:

A $L = 13x - 12$

B $L = 13x - 92$

C $L = 13x + 12$

D $L = 13x + 92$

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Solution: C

We'll start by finding $f(a)$.

$$f(a) = -a^2 + 5a - 4$$

So for $f(-4)$ we get

$$f(-4) = -(-4)^2 + 5(-4) - 4$$

$$f(-4) = -16 - 20 - 4$$

$$f(-4) = -40$$

Then $f'(a)$ is

$$f'(a) = -2a + 5$$

So $f(-4)$ is

$$f'(-4) = -2(-4) + 5$$

$$f'(-4) = 8 + 5$$

$$f'(-4) = 13$$

Now we can solve for the linearization using $f(-4) = -40$, $f'(-4) = 13$, and $a = -4$.

$$L = f(a) + f'(a)(x - a)$$

$$L = -40 + 13(x - (-4))$$

$$L = -40 + 13(x + 4)$$

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$$L = -40 + 13x + 52$$

$$L = 13x + 12$$

This is the linearization of the original function.

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